Claims

[c1] We claim:

1.A method of wireless data exchange amongst ad-hoc mobile devices of limited range within a communications network, the network comprising a plurality of mobile units including a source mobile unit and a destination mobile unit and a plurality of wireless communication links wirelessly connecting together, the said method comprising

-a special communicative protocol supporting a plurality of tasks in connection with ad-hoc network abilities (hereinafter CYRF protocol) (for the best fit)

a special communicative protocol supporting a plurality of tasks on global communications (GLOBAL MESSAGING TRANSPORT) (hereinafter GMT).

[c2]

- a special entertainment-, e-mail- and organizer type features, based on wireless ad-hoc networks" abilities gained by said protocols,

the said CYRF communicative protocol further comprising

-a routing method for providing data exchange among devices in network,

-a frequency division multiple access method,

-an registration data broadcasting method,

-RF output power control method,

-fail-safe file system;

the said GLOBAL MESSAGING TRANSPORT (GMT) further comprising

- special interfaces for data transfer amongst mobile devices and to/from global network;

the said special entertainment-, e-mail- and organizer type features further comprising

-Friend Finder,

-Wireless E-mail,

-Wireless Chat,

-Address/Phone Book,

-EZ Loader and Cyber Load,

2.The method of claim 1 wherein a routing method of for supporting ad-hoc mobile communications within a communications network further comprising:

- periodically transmitting an identifier signal by each of said plurality of mobile

units in the network and receiving said identifier signals via said communication links between said mobile units;

- evaluating (estimation of) the quality of said communication links between said mobile units in accordance with the time said identifier signals are being received from an associated mobile unit via said communication links;
- evaluating (estimation of) the quality of signal of said communication links between said mobile units in accordance with the signal strength measured on physical layer while receiving the signal from an associated unit via said communication link;
- selecting a communications route through the network from the source mobile unit to the destination mobile unit based on the quality of said communications links; and
- transmitting an information signal from said source mobile unit across said network via said selected communications route to said destination mobile unit,
- wherein said step of selecting a communications route comprises
- transmitting broadcast query signals from the source mobile unit across the network;
-appending route information to the broadcast query signals regarding the status of mobile units transmitting the broadcast query signals:
- receiving and evaluating the broadcast query signals at the source mobile unit,
- selecting a route through the network that was first received on source mobile unit; and
- transmitting a route identifier signal along every route through the network from the destination mobile unit to the source mobile unit,
- wherein the evaluating (estimation of) the quality of said communication links is processed .

[c3] 3.A routing method according to claim 2, wherein said communications links comprises various types of communication links, including wireless (radio frequency and infrared) and wired (LAN, serial and USB) links.

[c4] 4.A routing method according to claim 2, further comprising periodically transmitting an mapping signal consisting of random set of known identifiers of

associated mobile units by each of said plurality of mobile units in the network and receiving said mapping signals via said communication links between said mobile units;

5.A routing method according to claim 2, further comprising providing an associativity table at each mobile unit, each said associativity table storing regularly updated information regarding the quality of each communications link between said mobile unit and its associated mobile units.

[c5] 6.A routing method according to claim 4, further comprising storing in said associativity table information regarding associated mobile units not having direct communication link to the mobile unit but with information about a mobile unit that is intermediate for the destination.

[c6] 7.A routing method according to claim 2, further comprising providing information relating to the forwarding delay of each said communications link between said mobile unit and its associated mobile units.

[c7] 8.A routing method according to claim 2, further comprising providing a routing table at each mobile unit, each said routing table being configurable to set a route for passing said information signal through said mobile unit from one of its said associated mobile units to others of its said associated mobile units.

[c8] 9.A routing method according to claim 6, wherein each mobile unit represents a node of the communications network and each said routing table stores information regarding a source node, a destination node, an incoming associated node, an outgoing associated node and the distance of said mobile unit from the destination node and the distance of said mobile unit from the source node.

[c9] 10.A routing method according to claim 2, wherein the network supports a plurality of selected routes between respective source and destination mobile units, each mobile unit in the network being able to handle a plurality of selected routes and being able to store route relaying load information regarding the total number of selected routes supported by said mobile unit.

[c10] 11.A routing method according to claim 8, wherein said step of selecting communications route also comprises considering the route relaying load information stored in the mobile units.

[c11] 12.A routing method according to claim 2, further comprising:
- providing a seen table at each mobile unit, said seen table recording identifier data regarding an information signal which has passed through said mobile unit; and
- using said seen table to recognize and discard information signals that have previously been passed through said mobile unit.

[c12] 13.A routing method according to claim 2, wherein said information signal is provided in data packets, each data packet being arranged to hold routing information, control information and message information.

[c13] 14.A routing method according to claim 2, further comprising providing a data flow acknowledgment mechanism comprising passive acknowledgments, each said passive acknowledgment comprising receiving at a mobile unit an information signal previously sent by the mobile unit to one of its associated mobile units and retransmitted back thereby.

[c14] 15.A routing method according to claim 14, wherein said data flow acknowledgment mechanism further comprises active acknowledgments, each said active acknowledgment occurring when an information signal has reached its intended destination and retransmission would not occur passively, said active acknowledgment comprising the mobile unit receiving an active retransmission of an information signal sent by the mobile unit to its associated mobile unit acting as the destination node.

[c15] 16.A routing method according to claim 14 or 15, further comprising retransmitting said previously sent signal from said mobile unit to said associated mobile unit if a passive or active acknowledgment is not received within a predetermined time out period.

[c16] 17.A routing method according to claim 2, further comprising:
- appending quality of service information to the broadcast query signals, the

quality of service information containing criteria on route selection which are taken into account on selecting a route through the network.

[c17] 18.A routing method according to claim 2, wherein said route identifier signal configures mobile units along the selected route to pass forthcoming information signals between said source mobile unit and said destination mobile unit.

[c18] 19.A routing method according to claim 2, further comprising using of mapping table for sending route request directly to associated mobile device that is registered in said mapping table as an intermediate node to destination mobile device instead of broadcasting said request.

[c19] 20.A routing method according to claim 2, further comprising reconstructing the selected route in response to a change in the quality of one said communication links indicating a broken communication link invalidating the selected route.

[c20] 21.A routing method according to claim 20,, wherein mobile units along the selected route are configured to pass forthcoming information signals between the source mobile unit and the destination unit and said step of reconstructing the selected route comprises:

- identifying a pivot mobile unit in the selected communications route adjacent the broken communication link;
- transmitting a localized query signal from the pivot mobile unit across the network;
- appending route information to the localized query signal regarding the status of mobile units passing the localized query signal;
- receiving and evaluating the localized query signals at the destination mobile unit;
- selecting a new partial route through the network from the pivot mobile unit to the destination mobile unit, the selection being based on the stability of the communications links therebetween; and

configuring mobile units along the new partial route to pass forthcoming information signals between the source mobile unit and the destination mobile

unit.

[c21] 22.A routing method according to claim 21, further comprising:
appending quality of service information to the localized query signal, the quality of service information containing criteria on route selection which are taken into account on selecting a route through the network.

[c22] 23. A routing method according to claim 17, wherein said step of reconstructing the selected route further comprises:
reconfiguring the mobile units that were previously configured to be part of the selected route but which are not now part of the new partial route, to not be a part of the reconstructed selected route.

[c23] 24.A routing method according to claim 16, wherein said step of reconstructing the selected route comprises:
- transmitting broadcast query signals from the source mobile unit across the network;
- appending route information to the broadcast query signals regarding the status of mobile units passing the broadcast query signals;
- receiving and evaluating the broadcast query signals at the destination mobile unit;
- selecting a route through the network based on the stability of the communications links between mobile units; and
- transmitting a route identifier signal along the selected route through the network to the source mobile unit.

[c24] 25.A routing method according to claim 24, further comprising:
appending quality of service information to the broadcast query signals, the quality of service information containing criteria on route selection which are taken into account on selecting a route through the network.

[c25] 26.A routing method according to claim 16, wherein said step of reconstructing the selected route further comprises:
(a)identifying a pivot mobile unit in the selected communications route adjacent to the broken communication link;

(b)determining the distance between the identified pivot mobile unit and the destination mobile unit;

if the distance is greater than half the distance between the source mobile unit and the destination mobile unit,

transmitting a broadcast query signal from the source mobile unit across the network;

appending route information to the broadcast query signal regarding the status of mobile units passing the broadcast query signals;

receiving and evaluating the broadcast query signal at the destination mobile unit;

selecting a route through the network based on the stability of the communication links between the mobile units; and

transmitting a route identifier signal along the selected route through the network to the source mobile unit;

or otherwise:

transmitting a localized query signal from the pivot mobile unit across the network; and

appending route information to the localized query signal regarding the status of mobile units passing the localized query signal.

[c26]

27.A routing method according to claim 26, wherein said step of reconstructing the selected route further comprises:

(c)determining whether the localized query signal is received by the destination mobile unit within a predetermined time period;

if the localized query signal is received by the destination mobile unit within the predetermined time period

evaluating the localized query signal at the destination mobile unit-selecting a new partial route through the network form the pivot mobile unit to the destination mobile unit, the selection being based on the stability of the communication links therebetween and

configuring mobile units along the new partial route to pass forthcoming information signals between the source mobile unit and the destination mobile unit;

or otherwise:

identifying a new pivot mobile unit in the selected communication route adjacent to the previous identified pivot mobile unit, and carrying out step (b) on the basis of the new identified pivot mobile unit.

[c27] 28.A routing method according to claim 27, wherein step (c) is repeated until the destination mobile unit either receives the localized query signal or the broadcast query signal.

[c28] 29.A routing method according to claim 1, wherein mobile units along the selected route are configured to pass forthcoming information signals between the source mobile unit and the destination unit, further comprising deleting the selected route when it is no longer required, said deleting step comprising transmitting a deletion signal from the source mobile unit across the network, said deletion signal reconfiguring each mobile unit in the network.

[c29] 30.A routing method according to claim 2, wherein said routing method is arranged for use with fixed base station wireless local area networks as a back-up communications system in case of base station failure.

[c30] 31.A routing method according to claim 2, further comprising providing means for dynamically adjusting the transmission power of mobile units in the network in heavy usage conditions such that the number of relatively lightly-used communications links of a given mobile unit can be reduced thereby increasing the throughput of said mobile unit.

[c31] A routing method according to claim 2, further comprising discovering a new mobile unit and incorporating the new unit into the communication network, said incorporating step comprising:

detecting the presence of the new mobile unit to any of the mobile units of the communications network by measuring the quality of said communication links between the new mobile unit and an associated mobile unit; and establishing a communications link between the new mobile unit and its associated mobile unit.

[c32] 32.A routing method according to claim 31, further comprising:

determining the services provided by the new mobile unit; and notifying the mobile units in the communications network of the discovery of the new mobile unit and of the availability of its services.

[c33] 33.Method of claim 1, wherein communication devices, comprising means for data processing and RF transceiver (hereinafter radio communication means) operating within the fixed frequency band, providing the division of all or a part of said frequency band into two or more frequency channels (sub-bands), one of which is considered as base channel, and the others as operative ones, wherein all the variety of possible applications or tasks to be processed is preliminarily assigned on at least one channel, and one channel is being assigned to use for processing only account data of all the plurality of devices in network.

[c34] 34.Method of data exchange amongst communication devices of claim 33, wherein every kind of application or task is being assigned among assigned channels, so that for every channel is assigned one or more type of application or task.

[c35] 35.Method of data exchange amongst communication devices of claims 33, 34, wherein the job is processed by the following steps:
-every device periodically broadcasts its own account data;
-every device periodically collects account data about other communication devices within the accessible range on the specially assigned channel for account data exchange;
-the channel assigned for this type of job is being selected and occupied;
to process the joint job the devices switched to the channel where this job is currently being processed;
36.Method of data exchange amongst communication devices of claims 33-35, wherein for every radio communication mean is preliminarily assigned an identification number (ID).

[c36] 37.Method of data exchange amongst communication devices of claims 33-36, wherein account data includes at least device ID plus current occupied operative channel number.

[c37] 38.Method of data exchange amongst communication devices of claims 33-37, wherein for the account data storage about the surrounding devices in range, in the device"s memo is organized a special inner device list.

[c38] 39.Method of data exchange amongst communication devices of claim 33, wherein if for a specific type of job is assigned more then one channel, and at least one of the channels is occupied by other application, then the next not occupied channel number in the channel-job list is selected as an operative channel.

[c39] 40.Method of data exchange amongst communication devices of claims 33-39, wherein as an environment for data exchange is represented by radio-wave;
41.Method of data exchange amongst communication devices of claims 39,40, wherein data processing means are combined with RF transceiver;
42.Method of data exchange amongst communication devices of claim 37, wherein as data processing means are represented by computers.

[c40] 43.Method of data exchange amongst communication devices of claim 34, wherein for every type of job is assigned at least one operative channel.

[c41] 44.Method of data exchange amongst communication devices of claims 33-43, wherein for every operative channel is assigned at least one type of application.

[c42] 45.Method of data exchange amongst communication devices of claims 33-44, wherein the device comprises data processing means and RF transceiver.

[c43] 46.Method of data exchange amongst communication devices of claims 33-45, wherein every device periodically transfers and receives account data on the base channel.

[c44] 47.Method of data exchange amongst communication devices of claims 33-46, wherein the list of currently accessible devices is periodically refreshed.

[c45] 48.A method of data exchange amongst communication devices of claim 1, wherein signal output power control in adaptable peer communication network of portable mobile transceiving devices (at least two devices) combined transceiver and means for data input and/or processing, located within the

operational range, comprising the next steps

- at least two levels differing in output power are preliminary assigned,
- quality estimation of received signal,

wherein

- preliminarily assigning the connection signal quality levels (RSSI) (Received Signal Strength Indicator), on the comparison with which is assumed the decision about output power changes,
- quality estimation is carried out on each data receive session.

[c46] 49.The method of claim 48, wherein two levels of output are assigned, differing in power mode of regular power level and mode of extra power level, higher then the said regular power level.

[c47] 50.The method of claim 48 and 49, wherein preliminary assigned at least two levels for output power signal control (RSSI) - level 1 assumed as lower level of receiving signal satisfactorily quality, level 2 assumed as upper level for receiving signal.

[c48] 51.The method of claim 50, wherein quality level is estimated during each data receive session.

[c49] 52.The method of claim 50, wherein as an additional information on connection quality is assumed the regularity and quality level (RSSI) of receiving ping-signal (identification signal).

[c50] 53.The method of claim 50, wherein additional information field is included in the heading format of receiving information block (frame), and the value of said information field indicates the necessary output power level for information exchange between communicated devices.

[c51] 54.The method of claim 50, wherein accessible devices list format contains a special field for indicating the necessary output power level for communication with the device.

[c52] 55.A method of claim 1, wherein for increasing fault tolerance of a file system for carriers with a limited recording operation resource consisting in making an

identical format for all blocks of the carrier, reserved as accessible, each block of the carrier is given a block occupation attribute to consider it either busy of free for recording; file identifier; logical number of the file block; and the data size in the block is thus established. Meanwhile the format of the first block of the file will additionally have the file name.

[c53] 56.A method of claim 55, wherein protected file system with a limited recording operations resource containing carrier blocks reserved as accessible and having identical formats storing in a particular part of each block a busy attribute for defining the block as occupied or free for record, a file identifier distinct from those of the other files, a logical number of the block of the file and the data size in the block, in which case for the first block of the file its format additionally contains its file name, and at least its creation date and access attributes.

[c54] 57.A method of claim 1, wherein for expanding the coverage area for remote transmission and reception of information for networking clients equipped with a portable device combined with a limited-range radio transceiver. The ensured technical result increases the data communication efficiency between subscribers, including possibility of world-wide message exchange.

[c55]

wherein

to exchange messages numerous portable computer devices with limitedradio transceivers are united into a temporary network with a coverage area exceeding that of a separate portable computer device;

the portable computer device with a limited-range radio transceiver receives radio impulse signals from transceivers of other portable computers for retransmission of the message to the end user located outside the coverage area of the source of information;

sending a message, the portable computer device equipped with a multieventoperational system and with a unique identifier connected with the limited-range radio transceiver saves data which is a block of information and comprise a message, and transmit the message under the local radio network protocol in the form of impulse radio signals through the distribution

environment for the reception by the transceiver of at least one other portable computer device operating under the same protocol;
at least a part of the portable computer devices called rewith limited-range radio transceivers is equipped with a corresponding network interface and software to translate the messages into a protocol of network connection with similar devices though Internet/Intranet or with the message transfer control server through Internet/Intranet;
the server accumulates data on all ordinary portable computer devices operating in the local radio network mode and on all portable computer devices switched to the remode, under the network protocol that supports requests to lookup the devices globally and to estimate the quality of connection with them;
when an application running on an ordinal portable computer device sends a message whose receiver is out of the coverage area of the device, the message is transmitted to at least one reand the sender is switched into the mode of receiving notification about the message delivery or about the impossibility to accomplish the task;
when the message arrives to the reit is directly transmitted to the addressee, in the case when the latter is inside the recoverage area, otherwise, the resends either the message or the request to lookup addressee to the server;
when the message or the lookup request arrives, the server determines the location of another rewith the best quality of connection to the addressee, and either sends the message to the found redevice or sends the addressee location data to the requestor;
when there is no data about the message addressee on the server, the sender is notified about the impossibility to deliver the message;
when the message arrives to the redevice detected by the server, it sends the message directly to the receiver through local radio network;
after the message is successfully delivered, a corresponded notification is transmitted to the sender.

[c56]

58. A method of claim 1, wherein achieving the best fit of advantages of the method the several supplemental features are added to system
-- Friend Finder,

-Wireless E-mail,

-Wireless Chat,

-Address/Phone Book,

-EZ Loader and Cyber Load.